

I. Project Title: Gunnison River / Aspinall Unit Temperature Model: Phase II

II. Principal Investigators:

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III. Project Summary: Studies have postulated that changes in hydrology and water temperature releases from the Aspinall unit could benefit the Colorado pikeminnow. It is believed that by increasing the temperature of water released from the Aspinall Unit, the growth potential of Colorado pikeminnow in the Gunnison River below the Aspinall Unit at Delta, Colorado, will increase (Osmundson 1999). Temperature models can be used to determine the feasibility of achieving the desired river temperature warming at Delta through a combination of flow and release levels. The goal is to address the following issues:

1. Confirm results from Phase I indicating that a temperature control device at Blue Mesa Dam would result in warmer release temperatures from Crystal Dam.

2. Determine whether an increase in release temperatures from Crystal Dam would result in a significant increase in stream temperatures in the area around Delta, Colorado.

3. If so, determine how much warmer the release waters would need to be to meet the targets identified in Osmundson's 1999 report.

4. Determine how wet/normal/dry year inflows to the Aspinall Unit impact reservoir stratification and releases, and how these variations would impact the use of a temperature control device (TCD).
5. Determine time when temperature targets can be met in a wet/normal/dry year.
6. Determine impact of TCD on reservoir heat budget.
7. Determine the most feasible TCD options to achieve temperature targets.
8. Determine reservoir and release temperature response to flow recommendation.

Hydrosphere Resource Consultants (Hydrosphere) and Bureau of Reclamation (Reclamation) are joining effort to accomplish these tasks. Hydrosphere is to perform the following tasks: Application and calibration of the Aspinall reservoir models using CE-QUAL-W2, and development and calibration of the Gunnison River model. Reclamation will review model input data, the calibration process, and the scenario analysis.

IV. Study Schedule:

March 2002 to December 2003

V. Relationship to RIPRAP:

Colorado River Action Plan: Gunnison River

I.E. Initiate investigations of the feasibility of modifying releases from Aspinall Unit dams to increase water temperatures that would allow for upstream expansion of Colorado pikeminnow in the Gunnison River.

VI. Accomplishments of 2002 Tasks and Deliverables, Discussion of Initial Finding and Shortcomings:

Due to late funding on this project, input data for reservoir models were delivered from Hydrosphere on October 16, 2002. Reclamation reviewed all input data for reservoir modeling and provided the missing data to Hydrosphere with suggestions on calibration.

**MODEL DEVELOPMENT: RESERVOIR MODELS**

As of September 15, 2002, all required data have been obtained and some of it processed for the CE-QUAL-W2 temperature models of Blue Mesa, Morrow Point, and Crystal Reservoirs. The following is a list of key model input data and their source:

<i>Raw Data</i>	<i>Source</i>
Meteorological Data (air temperature, dew point temperature, wind speed, wind direction, cloud cover)	GUNNISON AP, CO (Gunnison Airport) HOURLY SURFACE AIRWAYS OBSERVATIONS Obtained through: Western Regional Climate Center Desert Research Institute Reno, NV
Tributary Inflows (Daily)	Lake Fork -- USGS Gage 09124500 (Lake Fork at Gateview)  Gunnison River -- USGS Gage 09114500 (Gunnison River Near Gunnison, CO)  (Note: Other tributary inflows [Soap Creek Cebolla Creek, W. Elk Creek, Cimarron River, Crystal Creek, Big Blue, Curecanti Creek, and Pine Creek] were estimated based on size of the contributing watershed and on other gage data in the watershed obtained prior to the simulation period.)
Reservoir Evaporation Data	Amy Thatcher, USBR, UC Regional Office
Temperature of Tributary Inflows	Matt Mallick, USFWS
Reservoir Releases (Daily)	Amy Thatcher, USBR, UC Regional Office
Outlet works configuration	Project Data Book
Reservoir Bathymetry	USGS 1:24,000 DLG Hypsography  EPA Reach 3 Hydrolines
Reservoir Area - Capacity Information	Rick Clayton, USBR, Upper Colorado Regional Office (via email)
Reservoir Contents (Daily)	Amy Thatcher, USBR, UC Regional Office
In-Reservoir Temperature Profiles (used for	Matt Mallick, USFWS

#### MODEL DEVELOPMENT: RIVER MODEL

A statistical model of Gunnison River temperatures is being developed using SimStat® software and will ultimately be implemented in Excel®. The river temperature model will be used to predict daily mean stream temperatures near the town of Delta that would result from changes in release temperatures from Crystal Dam. SimStat® uses a multiple regression analysis technique to determine the best fitting equation based on the sample data provided. It automatically includes or excludes variables from the final equation based on their contribution

to improving the predictive nature of the formula to identify the key independent variables controlling stream temperatures at Delta.

Data being used for this model development include:

<i>Raw Data</i>	<i>Source(s)</i>
Water Temperatures (hourly) at: Crystal Reservoir tailwater, Gunnison River above its confluence with the North Fork, North Fork of the Gunnison above its confluence with the Gunnison, and Gunnison River near Delta	George Smith, USFWS, Lakewood, CO. USBR USGS
Streamflows (daily mean)	Crystal Reservoir releases (USBR)  USGS gage "Gunnison River below Gunnison Tunnel" (09128000), USGS gage "North Fork of the Gunnison near Somerset, CO" (09132500), USGS gage "Uncompahgre River near Delta" (09149500)
Meteorological Data (air temperature, cloud cover)	GUNNISON AP, CO (Gunnison Airport)  HOURLY SURFACE AIRWAYS OBSERVATIONS  Obtained through:  Western Regional Climate Center Desert Research Institute

## DATA REVIEW

As outlined in the scope of work, the above model data will be forwarded to the project's co-principal investigator, Amy Cutler of the USBR, for review. Amy will also be reviewing the calibration results from the models when they become available. Through this review process, we intended to identify and resolve data and model issues early in the development process. Since Amy is also ultimately responsible for running the model scenarios, this process will help facilitate a smooth transfer of the models and data to her.

## VII. Recommendation:

Reclamation provided additional hourly meteorological data at Montrose, CO to Hydrosphere and recommended that this data set be used along with Gunnison, CO meteorological data.

Project is continuing by subtask as planned, although it is behind schedule overall due to delay in initial funding. We are still confident that we can complete this project by summer 2003.

VIII. Project Status: On track and ongoing.

IX. FY 2002 Budget Status:

	<u>USBR</u>	<u>Hydrosphere</u>	<u>Total</u>
A. Funds provided	\$3,700	\$61,070	\$64,770
B. Funds expended	<u>\$1,900</u>	<u>\$38,236</u>	<u>\$40,136</u>
C. Difference:	\$1,800	\$22,834	\$24,634
D. Percent FY2002 work completed:	50%	65%	63%
Projected costs to complete: covered by remaining funds			
E. Recovery Program funds spent for publication charges:	\$0		

X. Status of Data Submissions:

Submitted first Progress Report September 2002

Second Progress Report anticipated December 2002

Model Input files to be submitted to Amy Cutler (by Hydrosphere) December 2002

XI. Signed:

Amy Cutler & John Carron

Principal Investigators

November 26, 2002

Date